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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/715,000	11/20/2000	Hidemitsu Aoki	PF-2695	6696

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EXAMINER

LUU, CHUONG A

ART UNIT PAPER NUMBER

2825

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/715,000

Applicant(s)

AOKI ET AL.

Examiner

Chuong A Luu

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,5,7-19,21,23-33 and 57-64 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,5,7-19,21,23-33 and 57-64 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. 6) ☐ Other: _____

DETAILED ACTION

Inventorship

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

PRIOR ART REJECTION

Statutory Basis

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily

published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The Rejections

Claims 1-3, 11, 13, 16, 18-19, 27, 29, 32 and 57-64 are rejected under 35 U.S.C. 102(b) as being anticipated by Avanzino et al. (U.S. 6,350,687 B1)

Avanzino discloses a method of fabricating improved copper metallization by
(1) removing metal contaminations from said surface and simultaneously or subsequently carrying out an anti-corrosion treatment by exposing said surface of said semiconductor substrate to a solution containing an anti-corrosive agent (see column 6, lines 33-56);

subsequently, separately forming a copper-diffusion stopper insulating film (20) over said surface of said semiconductor substrate (see column 6, lines 56-65. Figure 2);

(2) wherein said surface of said semiconductor substrate includes at least one of a copper interconnection, a copper based interconnection and a copper alloy interconnection which are formed in a damascene method (see column 6, lines 24-32);

(3); (19) wherein said anti-corrosion treatment is carried out in a cleaning process after a chemical mechanical polishing process is carried out to said surface of said semiconductor substrate (see column 6, lines 33-65);

(11); (27) wherein a plurality of said five-membered hetero-cyclic compound comprise benzotriazole, (see column 6, lines 54-56);

(13); (29) wherein said anti-corrosive agent comprises at least one of aromatic compounds having benzene-rings and derivatives thereof (see column 6, lines 54-57);

(16) (32) wherein said copper-diffusion stopper insulating film comprises an SiN film (see column 6, lines 57-60);

(18) carrying out a chemical mechanical polishing process for forming said at least interconnection in at least a groove in said semiconductor substrate (see column 6, lines 33-65);

subsequently removing metal contaminations from a surface of said semiconductor substrate and simultaneously or subsequently carrying out an anti-corrosion treatment by exposing a surface of said semiconductor substrate to a solution containing an anti-corrosive agent (see column 6, lines 33-65);

subsequently, separately forming a copper-diffusion stopper insulating film **(20)** over said surface of said semiconductor substrate (see column 6, lines 55-65. Figure 2);

(57); (60) wherein said step of carrying out an anti-corrosion treatment comprises flows the anti-corrosive agent onto the surface of the substrate (see column 6, lines 33-56);

(58); (61) wherein said step of forming a insulating film comprises forming an insulating film by chemical vapor deposition (see column 6, lines 57-65);

(59); (62) wherein the copper-diffusion stopper insulating film comprises one of SiN film (see column 6, lines 59-60);

(63) removing metal contaminations from said surface and simultaneously carrying out an anti-corrosion treatment by exposing said surface of said semiconductor substrate to a solution containing an anti-corrosive agent (see column 6, lines 33-65);

subsequently, separately forming a copper-diffusion stopper insulating film (20) over said surface of said semiconductor substrate (see column 6, lines 55-65. Figure 2);

(64) wherein said semiconductor substrate has at least one interconnection made of a metal selected from the group consisting of copper, copper-based materials, and copper alloys, and said method further comprising the step of carrying out a chemical mechanical polishing process for forming at least one interconnection in at least one groove in said semiconductor substrate prior to said removing metal contaminations step (see column 6, lines 33-65);

Claims 8-10, 14, 24-26 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (U.S. 6,350,687 B1) in view of Lawson (U.S. 4,978,756)

Avanzino teaches everything above except for using specific chemical compounds and concentrations for corrosive treatment and cleaning procedures. However, Lawson discloses compounds can be used for the treatment of metal **(8)**; **(24)** wherein said anti-corrosive agent comprises at least one of hetero-cyclic compounds and derivatives thereof; **(9)**; **(25)** wherein said anti-corrosive agent comprises at least one selected from the groups consisting of four-membered hetero-cyclic compounds having two nitrogen atoms, five-membered hetero-cyclic compounds having three nitrogen atoms, six-membered hetero-cyclic compounds having three nitrogen atoms and derivatives thereof; **(14)**; **(30)** wherein said aromatic compounds having benzene-rings comprise gallic acids and tannic acids; **(10)**; **(26)** wherein one of said four-membered hetero-cyclic compounds comprises indazole (see column 1, lines 4-8, lines 9-11; column 2, lines 5-66; column 3, lines 28-57; column 4, lines 4-44; column 7, lines 48-58; column 17, lines 10-50; and column 18, lines 57-68). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the above teachings by apply certain chemical compounds and concentration to manufacture a semiconductor interconnection to enhance the performance of semiconductor device.

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Claims 5, 7, 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over over Avanzino et al. (U.S. 6,350,687 B1) in view of Admitted Prior Art (hereinafter APA)

Avanzino discloses everything above but fails to apply cleaning solution comprises a carboxylic acid. However, APA discloses a method for improving wafer surface with **(5); (7); (21); (23)** wherein said cleaning solution comprises a carboxylic acid based cleaning solution (see page 3, lines 1-5). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the above teachings by apply certain chemical compounds to clean a semiconductor interconnection during manufacture a semiconductor device.

Claims 12, 15, 17, 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (U.S. 6,350,687 B1)

Avanzino discloses the claimed invention except for using SiON film as copper-diffusion stopper insulating film material; wherein said at least one of gallic acids and tannic acids, anti-corrosion agent is contained in the range of 1 ppm to 5% . It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the teaching of Avanzino by selecting SiON film as copper-diffusion stopper insulating film material and the concentration of gallic acids, tannic acids and anti-corrosion agent, which is a well-known material in the semiconductor industry, since it has been held to be within the general skill of a worker in the art to select a

known material and concentration of chemicals on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Response to Arguments

Applicant's arguments filed March 12, 2003 have been fully considered but they are not persuasive.

In the light of the Applicant's argument that Avanzino do not disclose a need for removing any oxidation formed by the chemical mechanical polishing (CMP) process. However, it (removing any oxidation formed) does not recite in the claimed language. Applicant is noticed that claims 1, 18 and 63 in the present application should be given their broadest reasonable interpretation. In re Pearson, 494F. 2d 1399, 181 USPQ 641 (CCPA 1974). Therefore, the teaching of Avanzino by forming a passivation layer would act as a copper-diffusion stopper after removing copper compound and benzotriazole chemical treatment (anti-corrosive treatment).

Also, the Applicant's argument that Avanzino do not disclose or suggest removing metal contaminations from the surface and simultaneously carrying out an anti-corrosion treatment. However, Avanzino discloses a method of fabricating improved copper metallization ^{using anti-corrosive agent} (see column 6, lines 33-65).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chuong A Luu whose telephone number is (703)305-0129. The examiner can normally be reached on M-F (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (703)308-1323. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

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June 10, 2003


CARIDAD EVERHART
PRIMARY EXAMINER